

## Efficiency And Tendency Of The Educational Computer Games In Education: A Document Review

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### ABSTRACT

The computer and internet technologies which show an immediate change and development, show its effect in educational field as well as all fields of life. One of the implementation areas of computer and internet technologies is the computer games. While the computer games provide recreational time to the users, it may provide environments for learning some information. Particularly, the usage of the computer games which the school-age children like every much and play without getting bored in education, is an important matter to be considered. The purpose of this study is to determine the efficiency and integration process of the educational computer games to educational environments on the basis of literature by reviewing within the frame of the performed studies. Therefore, 45 thesis and articles including the scientific studies and the educational computer games till 2015, have been analyzed with the document analysis method. It is found in the document analysis that educational computer games have positive results nearly in all studies. It is observed that it has positive effects on the academic successes, problem solving skills, motor skills and attitude, affective specifications like motivation and self-efficiency of the students.

**Keywords:** Educational computer games, integration, document analysis, computer aided education.

### INTRODUCTION

Studies are made for a long time for the integration of education process and educational computer games (Altun, 2013), because, it may be provided to the students to learn with entertainment by using the computer games for education. It is required to provide maximum benefit from technology for obtaining permanent information and entertaining courses. As parallel to the developments in today's information and communication technologies, the computer games shows constant development (Tüzün, 2007). The insensible usage of computer games causes much time and effort loss particularly for the school-age children. From this point of view, the integration of the education and the computer games which the children spend much time and the amount of its benefit, is a major issue which is required to be researched.

As known, the game is an ongoing concept which bases on ancient era. Today, many adults spend most of their times by playing games (Karasan, 2013). To transfer the information and activities to the students through games, is an issue to be considered (Yeşilkaya, 2013). The perspective of the children who play educational games to their environment, world and life and they started to have a critical point of view. The child starts to question his environment and tries to evaluate as depending on the cause-effect relation. The child likes to know therefore he wants to play constantly and the games draw his attention (Fırat, 2011). Today, the adults and the children like computer games very much. The children generally play games in internet cafes due to the pressure and restrictions of the children. The addiction of the children for the computer games may be turned into an opportunity by being transported to class environment in educational game form.

Another point to be considered is the necessity of designing the games in the form that the children shall understand and play without getting bored. In the design of an educational games, the development specifications, individual differences, color tones, purpose of teaching the subject, self-evaluation of the child, the conformity of the behaviors shall be considered, because there are individual differences in the development levels of the children. The children have specific periods and these periods may be critical (Demiral, 2010). These critical periods may be intangible operational period or concrete operational period. Therefore, the development periods and stages are the important factors to be considered while designing and implementing the educational games. A sound basis of a modern education may be laid by providing the development of all kinds of physical, mental and psycho-motor by providing a good education to the children (Çağiltay, 2008).

The educators currently seek ways for including the educational games to the class studies (Su, 2008). In addition to this, there are many issues required to be considered before introducing the games to the class environment. Burenheide (2006) has determined six factors affecting the decisions of the teachers related with the usage of the games in class education:

- a. *Curriculum*: Providing or not providing outsources and evaluations mentioned in the curriculum in game environment.
- b. *Time*: To have wide curriculums and limited implementation time.
- c. *Logical concerns- teacher focused*: The problems that may occur in the organization of the environment and providing the control of the students in the classroom environment where the game is used.
- d. *Logical concerns- student focused*: Concerns related with the behaviors of the student during the activity (to make noise, not to sit down etc.).
- e. *Concerns of students' learning*: Whether the game provides active learning.
- f. *Concerns of students' satisfaction*: The feeling given by the educational games to the students, whether the game meets the needs like social interaction.

Different presentations of the information are needed in learning environment and opportunities must be created for providing this information in virtual word. Therefore the learning process must be supported and become easier (Pivec, 2007). However, the process must not be started before having the schools and teachers adapt to the ideas and techniques used in the new teaching methods. An unexpected technical failure may affect the motivations of the students. Therefore, the teacher must have the skill to solve the problems when needed. The digital games based learning is a new, unused approach in lifelong learning. While participating the students into this environment, the pedagogic experience shall be explained by making an orientation and the effects of a potential conflict that may arise from previous habits and experiences, must be minimized (Bakar, Tüzün, Çağıltay, 2008). If the games have a target for entering to the classes in schools, it must be used and loved by whole students. The game must be designed appropriately and must be designed according to the environment, a game environment with good scripts persuades the student groups for cooperation and orients the process.

Tüzün (2007), has mentioned about the high expectations of the students, the hardness of a logical harmony of the game environment and game fiction and the limitation conceptual frame by the students. However; he has expressed that the reliability of the infrastructure, efficiency and convenience of the information technologies shall be burden to the schools with limited budget. According to İnal (2007); the computer games shall have specifications that shall preserve the motivation in high level and shall attract the attention of the students. While providing the motivation, the educators shall consider to use the games for education, not for only entertainment. As can be understood from the literature, the computer games draw the attention of persons in all ages, particularly the children. This shows the importance of developing education computer games that shall turn the addition of children to the computer games into an opportunity. Therefore, the researchers are interested in the issue whether these games provide the learning and how much are these games efficient in education. From point of this view, the purpose of this study is to examine the integration process and efficiency of educational computer games to educational environment within the performed studies and to determine the confronted elements as depending on the literature. In this respect, the articles and dissertations till 2015 related with the educational computer games, are analyzed and the results are discussed.

## METHOD

Document reviewing method is used in this study for determining the tendency in the scientific studies for educational computer games. The research is limited with master-doctoral dissertations and articles. Document reviewing is a technique which carries out the analysis of printed and written materials in a specific matter (Yildirim & Simsek, 2005).

## Data Collection Tool

The literature search related with the educational computer games is made by using keywords like “game use in education”, “integration of game play in Education”, “game implementation in Education”, “game-based learning”, “educational computer games” and “educational games”. The search of the scientific researches is made in database of Web of Science and Google Academic. The search is limited with the experimental studies. At the end of the searches, total 75 studies are achieved. As the result of the prior review, 45 of the articles and dissertations are taken for analysis. The articles are analyzed with the Article Information Collection Form which is developed by the researcher.

### Analysis Of The Data

In the analysis of the data which are obtained through the document reviewing, frequency (f) and percentage (%) is used as descriptive statistics.

### FINDINGS

The purpose of the studies which are examined in research and these researches, methods, examined themes and results are given in Table 1. When Table 1 is analyzed, it may be expressed that the results are found as positive almost in whole studies and the educational computer games have positive effect on the sub-themes. Then, it is analyzed in terms of variables like yearly distribution of the studies, subject, participants, number of samples, research method and learning field. The obtained findings are given in graphics.

**Table 1:** The specifications of the studies which are analyzed in research

Author	Year	Aim of The Study	Method	Sample Size	Grade Level	Instrumentation	Examined Themes	Result
Offenbach	1964	To determine the effect of award and punishment in having pre-school and elementary school 4th grade students predict the most possible case by designing a game in probability.	Qualitative	60	Junior school	Achievement test	AS	Experiment group is more successful than control group
Polat ve Varol	2002	To analyze the effect of the hard, intangible, memorization-based subjects of Social Information course on the academic success with the education given by game.	Mixed	30	Junior school	Achievement test, survey	AS, AC	Experiment group is more successful than control group / Experiment group is more motivation than control group
Tüzün	2004	To identify the motivation elements for an online, multi-user educational computer game. To compare the experiences of the participants.	Qualitative	20	Secondary school	Observation, interview form	AC	Experienced students is more concerned than other
Danet	2004	To analyze Quest Atlantis (QA) games as an alternative educational tool. To measure the usability of a virtual environment for educational purpose.	Qualitative	7	Secondary school	Video recording, interview form	AC	Favorable
Altunay	2004	To determine the effect of game-supported mathematic education on the success of the students in courses and permanency of the learned information	Quantitative	67	Junior school	Achievement test	AS	Experiment group is more successful than control group
Şaşmaz Ören ve Avcı	2004	To analyze the educational games in science course on the academic success	Quantitative	33	Junior school	Achievement test	AS	Experiment group is more successful than control group
Meecharn	2005	To analyze the effect of the games on the learning.	Quantitative	31	Undergraduate	Achievement test, survey	LA	Favorable
Kula ve Erdem	2005	To analyze the educational computer games on the basic arithmetical process skills	Mixed	46	Junior school	Achievement test, interview form	AS, AC	Male students is more successful than female students

Obut	2005	To analyze the effect of the educational games designed in computer environment on the learning level of students of elementary school 7th grade	Quantitative	70	Junior school	Achievement test	AS	Experiment group is more successful than control group
Tural	2005	To determine the effect of education with the games and activities on the attitude of the students against the mathematics in elementary school 3rd grade mathematic course	Quantitative	52	Junior school	Achievement test, survey	AS, AC	Experiment group is more successful than control group
Zhang	2005	To compare the efficiency of the computer aided education method in teaching triangles with the traditional teaching methods.	Quantitative	108	Secondary school	Achievement test	AS	Indifferent
Hamalainen ve diğ.	2006	To determine the effect of 3-dimensional game environments on the cooperative learning.	Mixed	24	Undergraduate	Survey, Achievement test, Video recording, interview form	LA	Favorable
Lim, Nonis ve Hedberg	2006	To determine the effect of playing 3-B multi-users games in virtual environment on the attractiveness of Science Course	Quantitative		Junior school	Survey	AC	Favorable
Kızılkaya, Yılmaz-Soylu ve Tüzün	2006	To analyze the computer literacy of the university students in multi-user virtual environment	Quantitative	53	Undergraduate	Achievement test, survey	AS, AC	Favorable
Neimeyer	2006	To analyze whether the educational computer games have effect on the mathematical successes of the students	Quantitative	50	Secondary school	Achievement test	AS	Control group is more successful than experiment group
İnal ve Çağıltay	2007	To analyze the flow experience of the children within an interactive social game.	Mixed	33	Junior school	Observation, survey	LA	Puzzle style games in male, story-style games in female is more effective than other
Yağız	2007	To analyze the effect of the educational computer games on the successes in computer course and computer self-efficiency of the elementary school students	Quantitative	51	Junior school	Achievement test, survey	AS, AC	Indifferent
Tüzün	2007	To analyze the major issues and problems of the learning-purpose usages of video games (computer games) used in the classroom.	Mixed	77	Junior school, Secondary school Undergraduate	Achievement test, interview form	AC	Favorable, Experiment group is more successful than control group
Bayırtepe ve Tüzün	2007	To analyze the effect of the educational computer games on the successes in computer course and computer self-efficiency perceptions of the elementary school students	Mixed	51	Secondary school	Achievement test, survey, interview form	AS, AC	Favorable

Olson	2007	To determine whether the games have roles on developing the mathematical reasoning of the students	Qualitative		Junior school	Observation	RD	Favorable
Yağız	2007	To analyze the effect of the game-based learning environment on the successes in computer course and computer self-efficiency of the elementary school students	Quantitative	51	Junior school	Achievement test, survey	AS, AC	Favorable
Robertson ve Howells	2007	To analyze the motivations and determination of 6th grade students by having them design their own games	Qualitative		Secondary school	Observation	AC	Favorable
Abrams	2008	To analyze the effect of the computer games related with mathematic on the motivation and successes of the elementary and secondary school students	Quantitative	75	Junior school, Secondary school	Achievement test, survey	AS, AC	Success: Indifferent Attitude: Experiment group is more successful than control group
Kebritchi	2008	To analyze the effect of mathematical games on the mathematical successes and motivations of the high school students	Quantitative	193	High school	Achievement test	AS, AC	Experiment group is more successful than control group Motivation is indifferent
Bakar-H. Tüzün-K. Çağıltay	2008	To determine the opinions of the students related with the educational computer games in courses at formal training.	Qualitative	24	Secondary school	Interview form	AC	Experiment group is more motivation than control group
Virvou ve Katsionis	2008	To analyze the usability and lovability of the virtual reality games for the education	Qualitative	50	Secondary school	Interview form	AC	Experiment group is more effective than control group
Biriktir	2008	To present the interaction between the geometry teaching with game and the student	Quantitative	41	Junior school	Achievement test	AS	Experiment group is more successful than control group
Tatsis et all.	2008	To determine the thoughts of the children related with whether these games are fair by designing two games consisting of probability concepts for the pre-school	Qualitative		Kindergarten	Interview form	AC	Favorable
Erkuş	2008	To present whether the computer games with single user have effect on the word learning for university students.	Mixed	70	Undergraduate	Survey, interview form	AS	Indifferent
Tüzün, Yılmaz-Soylu, Karakuş, İnal ve Kızılkaya	2009	To analyze a computer game for geography learning for elementary school students	Quantitative	24	Junior school	Achievement test, survey	AS, AC	Experiment group is more intrinsic motivation than control group
Avcı, Sert,	2009	To determine the usage effects of the education computer games in	Quantitative		Junior school	Achievement test	AS	Favorable

Özdiç, Tüzün		information technologies course						
Malta	2010	To analyze effect of the educational computer games on the academic successes of the students	Quantitative		Secondary school	Achievement test	AS	Indifferent
Demiral	2010	To analyze the effect of judo educational games on the psychomotor skills in the children between 7-12 years old who learn judo.	Mixed	69	Junior school	Test form of motor skills	MS	Favorable
Long ve Frankie	2010	To develop the mathematical problem solving of the students with digital game design process.	Mixed		Secondary school	Survey, interview form	AC	Experiment group is more successful than control group Experiment group is more attitude and motivation than control group
Baytak ve Land	2010	To provide nutrition habits to the students by having the students design an education game -.	Qualitative		Junior school	Observation	AC	Favorable
İnal	2011	Physical interactive educational game design for children; to determine the design principles	Mixed	50	Secondary school	Achievement test, survey, Observation	AS, AC	Favorable
Güler	2011	To analyze the effect of educational games on academic achievement of 6 <sup>th</sup> grade students on the topic of “Cell and its organelles”	Quantitative	50	Secondary school	Achievement test	AS	Experiment group is more successful than control group
Firat	2011	To examine the effect of computer assisted instructional games on conceptual knowledge regarding some concepts of the topic of probability.	Quantitative	90	Junior school	Achievement test	AS	Experiment group is more successful than control group
Canbay	2012	To examine the effect of educational games on self-regulated learning strategies, motivational beliefs and academic achievements of 7 <sup>th</sup> grades.	Mixed	52	Secondary school	Survey, Achievement test, interview form	AS, AC, LA	Experiment group is more successful than control group Experiment group is more motivation than control group
Yıldırım	2012	To analyze the effect of educational mobile games , independent from time and space and more flexible in terms of learning compared with educational computer games, on academic achievement of elementary school students	Mixed	82	Secondary school	Survey, Achievement test, interview form	AS, AC	Experiment group is more successful than control group Experiment group is more motivation than control group
Altunay	2013	The analyze effect of educational games treated regularly on problem	Quantitative	60	Secondary	Survey	PSS	Experiment group is more

		solving skill of children from 11-12 age group.		school		successful than control group
Duman	2013	To determine the effect of educational games on children's attitudes towards fine arts.	Mixed	40 Junior school	Achievement test, survey, Observation	AS, AC Favorable
Yeşilkaya	2013	To determine the effect of educational games on 7 <sup>th</sup> graders' academic achievement and attitudes toward social sciences studied the topic of "science over time"	Quantitative	50 Secondary school	Achievement test, survey	AS, AC Indifferent
Kızılkaya, Cumaoğlu	2014	To examine the effect of using different educational software for word teaching on students' academic achievements and word learning strategies word teaching. (Tutorials and educational games)	Quantitative	68 Secondary school	Achievement test, survey	AS, LA Favorable
Bulut	2015	To examine effect of educational games designed by 5 <sup>th</sup> and 6 <sup>th</sup> graders through blended learning method on creative thinking skill.	Mixed	23 Secondary school	Survey, Observation	AC Favorable

**Examined Themes:** Affective Characteristics (motivation, attitude, self-confidence): AC  
Problem Solving Skills: PSS  
Academic Success: AS  
Learning Approach : LA  
Reasoning Development: RD  
Motor Skills: MS

#### Distribution of studies published on Journals by years

The distribution of studies examined is given on the figure 1. It can be seen that empirical studies regarding educational games mostly were published on 2007 (21%) and 2008 (18%). Until 2011 this topic was preferred by researchers; however it lost its popularity in subsequent years. This finding shows that the effects and educational aspects of educational computer games have been discussed mostly between the years of 2005-2011.

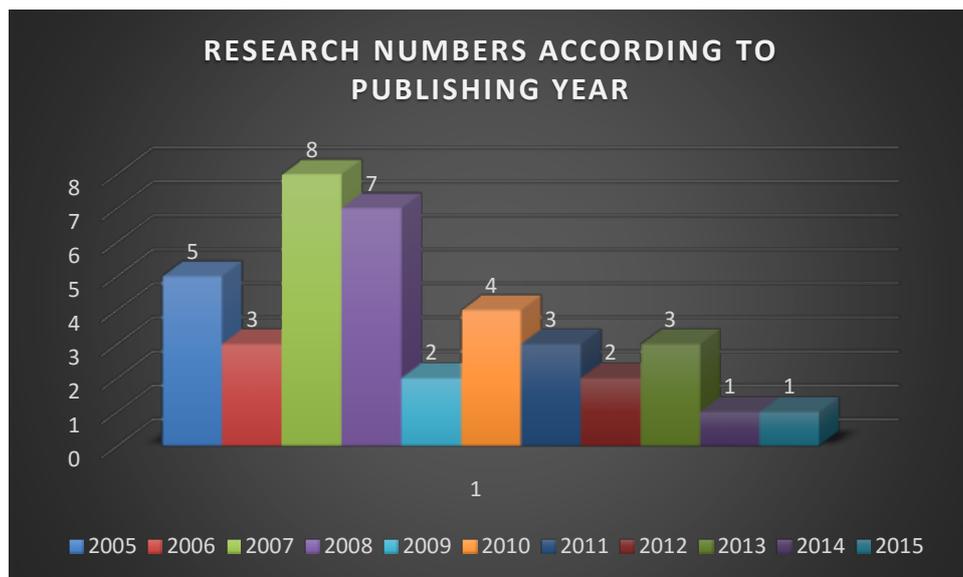


Figure 1. The yearly distribution of the analyzed researches

#### The distribution of the researches based on participants

The distribution of target group in studies examined is given on the figure 2. It can be seen that from the figure 2, researchers have preferred mostly to work with elementary school students (43%) and secondary school students

(41%). This finding shows that educational games mostly used in elementary and secondary school level. It is also found that the topic that will be gamificated is chosen based on easy fictional and requiring simple operations. Moreover, when age groups are considered, it can be said that mostly students aged 9-14 were mostly preferred to work with.

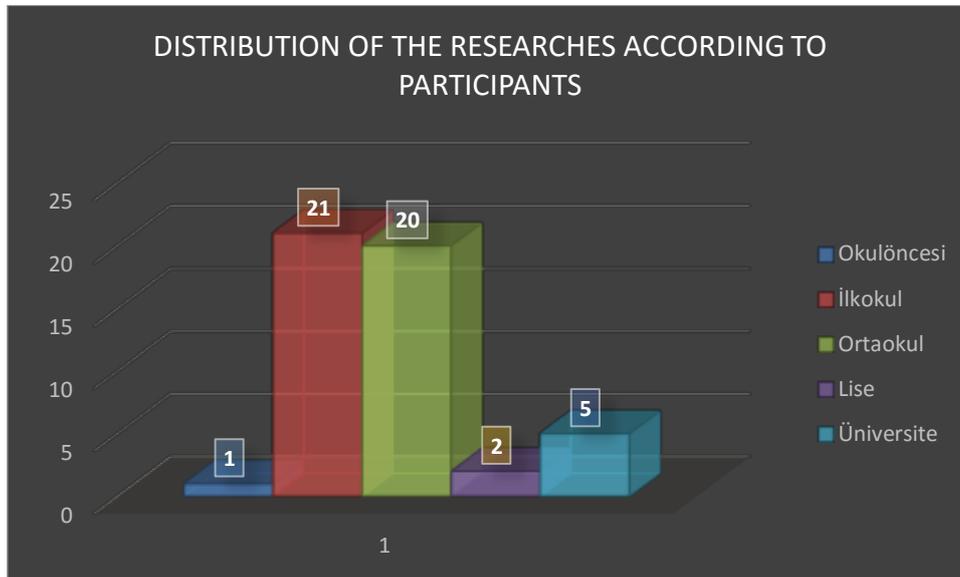


Figure 2. Distribution of the researches according to participants

#### Data Collection Tools used in the research

Data collection techniques used in the framework of research methods is given in the figure 3. It shows that researcher mostly have used academic achievement test (40%) and questionnaire (29%) which are quantitative data collection tools. In most of researches, control group pretest - posttest experimental design was chosen. The difference between participants' academic achievement, and affective characteristics including attitudes and motivations were mostly examined in researches. The figure shows the percentages of using interviews in researches is 20.

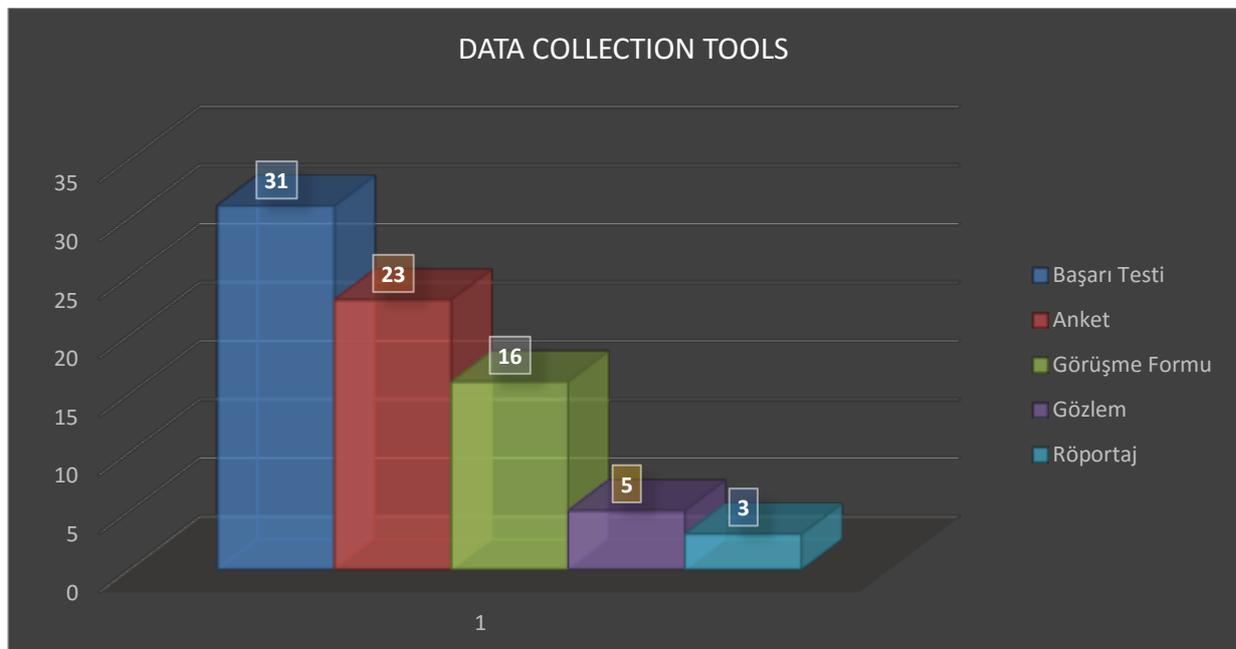


Figure 3. Data collection tools used in analyzed researches

#### The distribution of topics analyzed in researches.

The topics analyzed in researches are given on the figure 4. The issues handled in researches can be divided into six categories; academic achievements, affective characteristics (motivation, attitude and self-confidence), the

effect of learning approach, developing reasoning, problem solving skills and motor skills. The figure 4 shows that the most examined issued are academic achievement (44%) and affective characteristics (40%). In addition, the development of reasoning, problem solving and motor skills have been also examined.

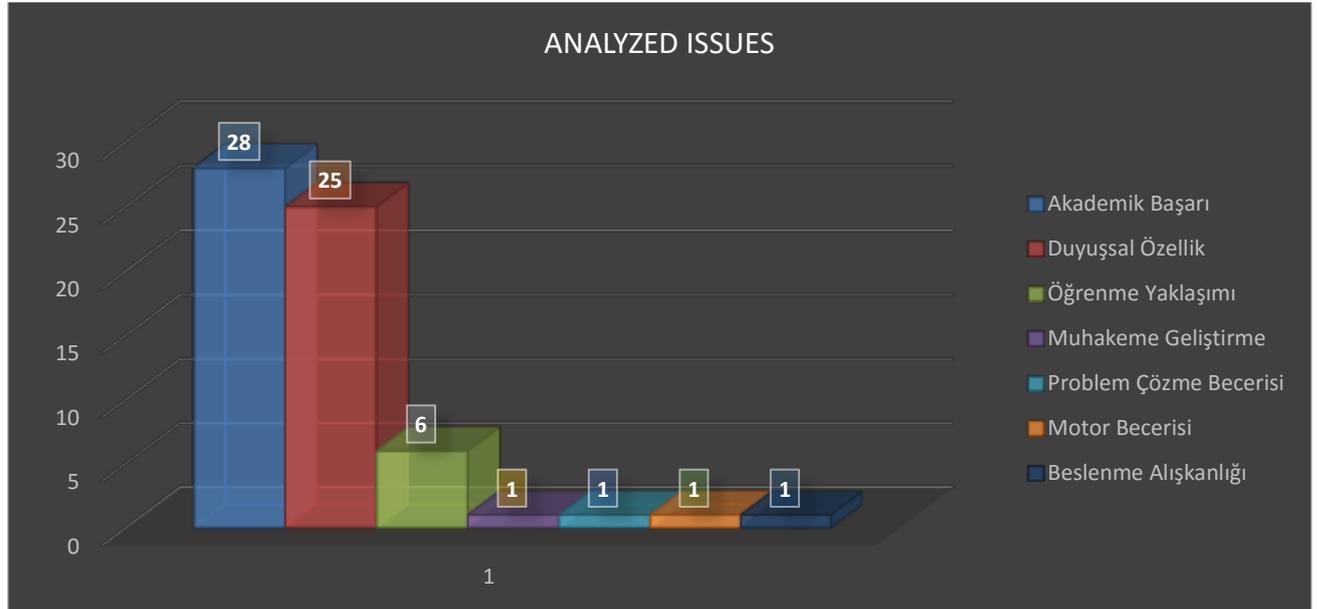


Figure 4. Examined issues

## DISCUSSION AND RESULT

In this study, 45 theses and articles cover in scientific studies conducted about educational computer games until 2015 by document analysis method and it is found that educational computer softwares provide positive results. It is seen that educational computer software has positive effect on students' academic achievements, problem solving skills, motor skills and affective characteristics including attitude, motivation and self- sufficiency. Moreover, the target population is mostly preferred as elementary and secondary school students. In most of studies, quantitative data collection tools including academic achievement test and questionnaire have been used. There are limited number of qualitative researches.

As a result of document analysis, it is concluded that educational computer games may help to learn abstract concepts that are difficult to learn and to establish more powerful relational connections among them.

As a result of researches and literature analysis conducted, it is found that design elements of educational computer software has impact on learning. It is also seen during treatment some problems aroused due to limited time, technological infrastructure and participants' behaviors and attitudes. Moreover, it is also found that in the integration process of technology and rich educational innovation to formal education, some factors including technological infrastructure compliance, plan and preparation, teacher training, orientation, increasing in workload of teachers, technical support and guidance should be considered. About the design of education software, some problems aroused about necessary financial resources and time, fictionalization of a pedagogically good story, high expectation of users and orientation of users into game environment. It is also seen that students have high expectations on game-based learning environment.

The integration process of computer based environment into educational environment has four components such as pedagogical aspect, technical infrastructure aspect, students and teacher and student size and peer-to-peer size. There are some issues to be considered in the design process of the model to be developed by considering these components. One of them is to develop flexible education programs which provide opportunity for using computer games because implementing educational games to the traditional education programs, is a hard process. Another issue is that the computer games must be designed within the frame of updated learning approaches because the updated learning approaches adopt the progressivism in educational philosophy and this student-centered educational philosophy takes the student to the center and designs the process accordingly. Therefore, in the design of the complex technology implementations such as computer games used in educational environment, the classic design methods such as ADDIE are insufficient. Updated methods like design-based research method which shall make contribution to both design and research of these kind of technologies in developing such environments. The individual difference must be considered and the design shall be made by considering the individual specifications of the student. To implement the educational computer

games into class environment is a hard process. In-service trainings for using the computer games in class environments, should be given to the teachers who have major responsibilities in this process. Besides, it is obligatory for the game environment and the game fiction to have a logical harmony. The designers must spend more time in design process by considering such cases.

Under the light of this information, below suggestion may be provided.

- The educational computer games shall be designed by considering the individual specifications of the students.
- The educational computer games shall be designed within the frame of updated learning theories.
- The educational computer games shall be in the qualification that shall provide upper level thinking skills to the students.
- The researches which select the university students as the participants, may provide more different sizes for the educational computer games.
- It maybe suggested to use qualitative tools like observation form, interview form rather than quantitative data collection tools in the studies to be performed.

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